PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-086567
(43)Date of publication of application : 26.03.2002

(51)Int.Cl. B29C 65/16

(21)Application number : 2000-273851
(22)Date of filing : 08.09.2000

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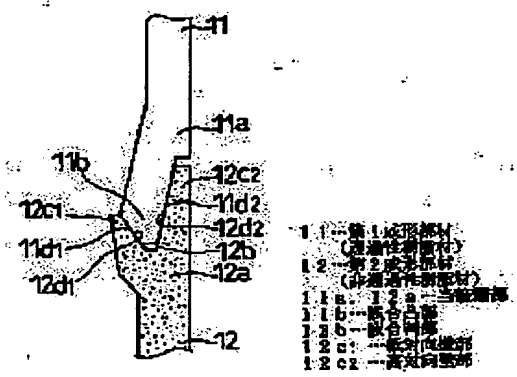
(54) RESIN MOLDING

(57)Abstract:
PROBLEM TO BE SOLVED: To sufficiently secure a range which can be irradiated with laser beams and a welding area which can be welded by laser beams by devising a shape in unevenness-engagement while the generation of a gap is prevented by the unevenness-engagement between the contact end parts of a permeable resin material and a non-permeable resin material.
SOLUTION: An engagement-projected part 11b is formed in the contact end part 11a of a first molding member 11 of a permeable resin material which allows the permeation of laser beams as a heat source, and an engagement- recessed part 12a is formed in the contact end part 12a of a second molding member 12 of a non-permeable resin material which does not allow the permeation of the laser beams. A pair of facing wall parts which forms the recessed part 12b comprises a higher facing wall part 12c2 and a lower facing wall part 12c1. By emitting laser beams from the side of the lower facing wall part 12c1, the range which can be irradiated with the laser beams and the welding area which can be welded by the laser beams can be secured sufficiently.



LEGAL STATUS

[Date of request for examination]	15.10.2002
[Date of sending the examiner's decision of rejection]	17.08.2004
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	2004-19234
[Date of requesting appeal against examiner's	16.09.2004

decision of rejection]
[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] It consists of penetrable resin material which is penetrable to the laser beam as a source of heating, and nontransparent nature resin material which is opaque to this laser beam. In the resin mold goods to which joining of the contact edges of this penetrable resin material and this nontransparent nature resin material was carried out by the exposure of this laser beam from this penetrable resin material side, and they were joined, while fitting heights are prepared in the above-mentioned contact edge of the above-mentioned penetrable resin material Resin mold goods characterized by forming one side of the opposite walls of the couple which these fitting heights and the fitting crevice which can be fitted in are established in the above-mentioned contact edge of the above-mentioned nontransparent nature resin material, and forms this fitting crevice in height lower than another side.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the resin mold goods which joined in one **, the penetrable resin material which is penetrable to a laser beam in detail, and the nontransparent nature resin material which is opaque to this laser beam by laser joining about resin mold goods.
[0002]
[Description of the Prior Art] It is performed frequently that the components of various fields, such as autoparts, are resinified and resin mold goods take more in recent years than viewpoints, such as lightweight-izing and low-cost-izing. Moreover, resin mold goods are beforehand divided

and fabricated from viewpoints, such as a raise in the productivity of resin mold goods, to plurality, and a means to join these division mold goods of each other is taken in many cases.
[0003] The laser joining approach is conventionally used here as the junction approach of resin material. For example, after laying the penetrable resin material which is penetrable to a laser beam, and the nontransparent nature resin material which is opaque to this laser beam on top of JP,60-214931,A, the laser joining approach which is made to carry out heating melting of the contact sides of penetrable resin material and nontransparent nature resin material, and joins both in one is indicated by irradiating a laser beam from this penetrable resin material side.
[0004] By this laser joining approach, the laser beam which the laser beam which penetrated the inside of penetrable resin material arrived at the contact side of nontransparent nature resin material, was absorbed, and was absorbed by this contact side is accumulated as energy. Consequently, while heating melting of the contact side of nontransparent nature resin material is carried out, heating melting of the contact side of penetrable resin material is carried out by heat transfer from the contact side of this nontransparent nature resin material. In this condition, if the contact sides of penetrable resin material and nontransparent nature resin material are made to stick by pressure, both are joinable in one.
[0005]
[Problem(s) to be Solved by the Invention] By the way, in laser joining which was described above, in order to carry out joining of the contact sides of penetrable resin material ********** resin material certainly and to obtain sufficient bonding strength, it is not necessary to make the clearance between the contact sides of penetrable resin material and nontransparent nature resin material small or anything as much as possible. If a clearance is located in this contact side, since generation of heat in the contact side of nontransparent nature resin material will become that heat transfer is hard to be carried out to the contact side of penetrable resin material, it is because heating melting in the contact side of penetrable resin material serves as imperfection and contact sides stop fully welding.
[0006] Then, while preparing fitting heights in the contact edge of penetrable resin material, the means which makes small the clearance between the above-mentioned contact sides as much as possible can be considered by establishing a fitting crevice in the contact edge of nontransparent nature resin material. According to this means, the curvature in a contact edge etc. is corrected and the mechanical bonding strength by concavo-convex fitting enables it to make the clearance between contact sides small.
[0007] However, when fitting heights and a fitting crevice are established in the contact edge of penetrable resin material and nontransparent nature resin material, nontransparent nature resin material may interrupt that the laser beam irradiated by the exposure location of the configuration of the concavo-convex section or a laser beam etc. carries out incidence to penetrable resin material. For this reason, the problem that the range of a laser beam which can be irradiated narrow-izes, or the joining area in which laser joining is carried out and it deals narrow-izes, and bonding strength becomes imperfection occurs.
[0008] This invention being made in view of the above-mentioned actual condition, carrying out concavo-convex fitting of the contact edge of penetrable resin material and nontransparent nature resin material, and preventing generating of the above-mentioned clearance, the configuration in this concavo-convex fitting is devised, and let it be the technical technical problem which should be solved to offer the resin mold goods which can fully secure the range of a laser beam which can be irradiated, and the joining area in which laser welding is possible.
[0009]
[Means for Solving the Problem] The penetrable resin material in which the resin mold goods of this invention which solves the above-mentioned technical problem have permeability to the laser beam as a source of heating, In the resin mold goods to which it became from the nontransparent nature resin material which is opaque to this laser beam, and joining of the contact edges of this penetrable resin material and this nontransparent nature resin material was carried out by the exposure of this laser beam from this penetrable resin material side, and they were joined While fitting heights are prepared in the above-mentioned contact edge of the above-mentioned penetrable resin material These fitting heights and the fitting crevice which

can be fitted in are established in the above-mentioned contact edge of the above-mentioned nontransparent nature resin material, and one side of the opposite walls of the couple which forms this fitting crevice is characterized by being formed in height lower than another side.
[0010]
[Embodiment of the Invention] The resin mold goods of this invention consist of penetrable resin material which is penetrable to the laser beam as a source of heating, and nontransparent nature resin material which is opaque to this laser beam, and the contact edges of this penetrable resin material and this nontransparent nature resin material are joined by laser joining in one. This laser joining is in the condition which the contact edges of penetrable resin material and nontransparent nature resin material were made to contact, and is performed by irradiating a laser beam from a penetrable resin material side. The laser beam irradiated from the penetrable resin material side penetrates the inside of this penetrable resin material, arrives at the contact side of nontransparent nature resin material, and is absorbed. As a result of accumulating as energy the laser beam absorbed by the contact side of this nontransparent nature resin material, while heating melting of the contact side of nontransparent nature resin material is carried out, heating melting of the contact side of penetrable resin material is carried out by heat transfer from the contact side of this nontransparent nature resin material. In this condition, if the contact sides of penetrable resin material and nontransparent nature resin material are made to stick by pressure, both are joinable in one.
[0011] In this way, in the obtained joint, among these planes of composition, melting of the planes of composition is carried out, and they are joined, and both the resin that constitutes both the shaping member fuses, and since the condition of having entered mutually and having twined is formed, a firm junction condition is constituted and it has high bonding strength and high pressure resistance.
[0012] While fitting heights are prepared in the contact edge of penetrable resin material in the resin mold goods of this invention, these fitting heights and the fitting crevice which can be fitted in are prepared at the contact edge of nontransparent nature resin material, and the fitting heights of penetrable resin material and the fitting crevice of nontransparent nature resin material have fitted in here. Since the curvature in the contact edge of penetrable resin material and nontransparent nature resin material etc. is corrected by the mechanical bonding strength by this concavo-convex fitting, it can suppress that a clearance occurs between the contact side of penetrable resin material, and the contact side of nontransparent nature resin material. For this reason, the contact side of penetrable resin material can be made to be able to carry out heat transfer of the generation of heat in the contact side of nontransparent nature resin material certainly, and heating melting of the contact side of penetrable resin material can be carried out certainly. Therefore, it becomes possible to carry out laser joining of the contact sides of penetrable resin material and nontransparent nature resin material certainly.
[0013] Moreover, the fitting crevice established in the contact edge of nontransparent nature resin material is formed in height with one side lower than another side of the opposite walls of the couple which forms this fitting crevice. For this reason, it can stop that the irradiated laser beam is interrupted by nontransparent nature resin material (opposite wall of the side by which a laser beam is irradiated) by irradiating a laser beam from an opposite wall side with lower height. Therefore, it becomes possible to fully secure the range of a laser beam which can be irradiated, and the joining area in which laser welding is possible.
[0014] Furthermore, in the resin mold goods of this invention, while preparing fitting heights in penetrable resin material, the fitting crevice is established in nontransparent nature resin material. Here, the all are not absorbed in an applicable plane of composition, and, as for the laser beam which penetrated the inside of penetrable resin material and arrived at the contact side (inner surface of a fitting crevice) of nontransparent nature resin material, a part is reflected. For this reason, in addition to dispersion of the laser beam in penetrable resin material, it becomes possible by using the echo of the laser beam in the inner surface of the fitting crevice of nontransparent nature resin material to carry out laser welding of the outside surface of fitting heights, and the inner surfaces of a fitting crevice uniformly [abbreviation] more widely.

[0015] Especially if one side of the opposite walls of the couple which forms this fitting crevice is formed in height lower than another side as a configuration of the fitting crevice established in the contact edge of the above-mentioned nontransparent nature resin material, it will not be limited, for example, it can consider as cross-section configurations, such as the shape of the shape of the shape of substantially inverted trapezoidal, and an abbreviation semicircle, or an abbreviation triangle.
[0016] It will not be limited, especially if have thermoplasticity, the laser beam as a source of heating is made to penetrate above predetermined permeability and it gets as a class of resin used for the above-mentioned penetrable resin material. For example, polyamides (PA), such as nylon 6 (PA6) and Nylon 66 (PA66), polyethylene (PE), polypropylene (PP), a styrene acrylonitrile copolymer, polyethylene terephthalate (PET), polystyrene, ABS, an acrylic (PMMA), a polycarbonate (PC), polybutylene terephthalate (PBT), etc. can be mentioned. In addition, what added reinforcement fiber and coloring matters, such as a glass fiber and carbon fiber, may be used if needed.
[0017] As a class of resin used for the above-mentioned nontransparent nature resin material, it has thermoplasticity, and especially if it may absorb without making the laser beam as a source of heating penetrate, it will not be limited. For example, what mixed predetermined coloring matters, such as carbon black, a color, and a pigment, in polyamides (PA), such as nylon 6 (PA6) and Nylon 66 (PA66), polyethylene (PE), polypropylene (PP), a styrene acrylonitrile copolymer, polyethylene terephthalate (PET), polystyrene, ABS, an acrylic (PMMA), a polycarbonate (PC), polybutylene terephthalate (PBT), PPS, etc. can be mentioned. In addition, what added reinforcement fiber, such as a glass fiber and carbon fiber, may be used if needed.
[0018] Moreover, about the combination of the resin used for the above-mentioned penetrable resin material, and the resin used for the above-mentioned nontransparent nature resin material, it considers as the combination of what have compatibility mutually. As this combination, the combination of others, nylon 6, and Nylon 66, the combination of PET and PC, the combination of PC and PBT, etc. can be mentioned. [combination / of resin of the same kind, such as nylon 6 and Nylon 66,]
[0019] Moreover, as a class of laser beam used as a source of heating, it is relation with an absorption spectrum of penetrable resin material, board thickness (transparency length), etc. which make a laser beam penetrate, and what has wavelength from which the permeability within penetrable resin material becomes beyond a predetermined value is selected suitably. For example, YAG:Nd3+ laser (wavelength of a laser beam: 1060nm) and semiconductor laser (wavelength of a laser beam: 500-1000nm) can be used.
[0020] In addition, exposure conditions, such as an output of laser, an exposure consistency, and working speed (passing speed), can be suitably set up according to the class of resin etc.
[0021]
[Example] Hereafter, the concrete example of this invention is explained based on a drawing.
[0022] This example applies the resin mold goods of this invention to the intake manifold made of synthetic resin.
[0023] Drawing 1 is the top view of an intake manifold. Drawing 2 expands and shows the amputation stump side cut by the A-A line in drawing 1 of an intake manifold.
[0024] This intake manifold 10 is the hollow object which is carried out 2 ****s up and down, and consisted of a 1st shaping member 11 which is the upside part segmenter, and a 2nd shaping member 12 which is the bottom part segmenter. The 1st shaping member 11 and the 2nd shaping member 12 have the contact edges 11a and 12a which have consistency mutually and contact each other, respectively. And the contact sides of contact edge 11a of the 1st shaping member 11 and contact edge 12a of the 2nd shaping member 12 are joined by laser joining in one.
[0025] the glass fiber which the 1st shaping member 11 consists of penetrable resin which is penetrable to the laser beam as a source of heating, and is reinforcing materials in this example as this penetrable resin at nylon 6 -- 30wt(s)% -- the reinforced plastics which it comes to add was used. however, glass fiber -- 30wt(s)% -- as compared with the plastics made from glass fiber non-adding nylon 6, the permeability of a laser beam is falling 30% by having added. In addition, the laser beam used for an exposure is YAG:Nd3+ laser (wavelength: 1060nm).

[0026] Moreover, the 2nd shaping member 12 consists of nontransparent nature resin which is opaque to the laser beam as a source of heating, and the reinforced plastics which comes suitably to carry out amount addition of the carbon black which is 30wt(s)% and an adjuvant (coloring matter) about the glass fiber which is reinforcing materials was used for nylon 6 by this example as this nontransparent nature resin.
[0027] In addition, the 1st shaping member 11 and the 2nd shaping member 12 all use nylon 6 as base material resin, and have compatibility mutually.
[0028] The cross-section configuration is presenting abbreviation semicircle tubed as the part shown by the A-A line of drawing 1 expands the 1st shaping member 11 by drawing 2 and it is shown. Contact edge 11a is prepared in the open end of the 1st shaping member 11 which makes this abbreviation semicircle tubed.
[0029] Annular fitting heights 11b which projects caudad is prepared in contact edge 11a of the 1st shaping member 11 as this part is expanded further and shown in drawing 3 . This fitting heights 11b is making the cross-section configuration of the abbreviation trapezoidal shape which contracts gradually and projects toward a head side (lower part side). And let 1 be die length shorter [11d of long dip side faces of an opposite hand] than 2 11d of near (left-hand side of drawing 3) short dip side faces in which a laser beam is irradiated.
[0030] On the other hand, the above-mentioned fitting heights 11b and annular fitting crevice 12b which can be fitted in are prepared in contact edge 12a of the 2nd shaping member 12. This fitting crevice 12b is made into the configuration adjusted with the above-mentioned fitting heights 11b, and is making the cross-section configuration of abbreviation trapezoidal shape where opening spreads gradually toward the upper part from a base. And one of the opposite wall 12c1 of the couple which forms fitting crevice 12b, and 12c2 is formed in height lower than another side. That is, let the low opposite wall 12c1 of the side (left-hand side of drawing 3) by which a laser beam is irradiated be height lower than the high opposite wall 12c2 of an opposite hand. In addition, the inner surface of the low opposite wall 12c1 is set to 1 12d of short dip side faces by which laser joining is carried out in contact with 1 the 11d of the above-mentioned short dip side faces, and the inner surface of the high opposite wall 12c2 is set to 2 12d of long dip side faces by which laser joining is carried out in contact with 2 the 11d of the above-mentioned long dip side faces.
[0031] In more detail, as shown in drawing 4 , 1 inclines at an angle of alpha to a center line C 12d of 11d short dip side faces of 1 and fitting crevice 12b of short dip side faces of fitting heights 11b, and 2 inclines at an angle of beta to a center line C 12d of 11d long dip side faces of 2 and fitting crevice 12b of long dip side faces of fitting heights 11b. Moreover, the height of the low opposite wall 12c1 of fitting crevice 12b is H1, the height of the high opposite wall 12c2 of fitting crevice 12b is H2, and both difference is set to h (=H2-H1).
[0032] In this way, while fitting of the fitting crevice 12c of fitting heights 11c of the 1st shaping member 11 and the 2nd shaping member 12 is carried out Contact side 12b (the short dip side face 12e1 and the long dip side face 12e2 of fitting crevice 12c) of contact side 11b (the short dip side face 11e1 and the long dip side face 11e2 of fitting heights 11c) of the 1st shaping member 11 and the 2nd shaping member 12 is joined by laser joining in one.
[0033] The resin mold goods of this example which has the above-mentioned configuration were manufactured as follows. First, the 1st shaping member 11 and the 2nd shaping member 12 were beforehand injection molded in the predetermined configuration using the predetermined injection-molding mold. And while carrying out fitting of fitting heights 11c of the 1st shaping member 11, and the fitting crevice 12c of the 2nd shaping member 12, contact side 11b of the 1st shaping member 11 and the 2nd shaping member 12 and 12b were made to contact. In this condition, the laser beam was irradiated toward fitting crevice 12c of the 2nd shaping member 12 using the laser torch which is not illustrated from the 1st shaping member 11 side. That is, the laser beam was irradiated toward the inner surface 12e1 of fitting crevice 12c, i.e., the short dip side face of fitting crevice 12c, and the long dip side face 12e2 from 12d 1 side of low opposite walls with lower height among the opposite walls of the couple which forms fitting crevice 12c of the 2nd shaping member 12. Thereby, heating melting of contact side 11b of contact edge 11a of the 1st shaping member 11 and contact edge 12a of the 2nd shaping member 12 and the 12b

was carried out extensively, and both were joined in one by laser joining.
[0034] Thus, in the resin mold goods of this example, as for fitting crevice 12c prepared in contact edge 12a of the 2nd shaping member 12 which consists of nontransparent nature resin material, height is made [12d of low opposite walls of the side by which a laser beam is irradiated] lower than 2 for 1 12d of high opposite walls of an opposite hand. For this reason, it can stop that the irradiated laser beam is interrupted by nontransparent nature resin material (opposite wall of the side by which a laser beam is irradiated) by irradiating a laser beam from 12d 1 side of low opposite walls with lower height. Therefore, it becomes possible to fully secure the range of a laser beam which can be irradiated, and the joining area in which laser welding is possible.
[0035] In this way, in the obtained joint, between applicable plane-of-composition 11b and 12b, melting of contact side 11b and the 12b is carried out extensively, and they are joined, and both the resin that constitutes both the shaping members 11 and 12 fuses, and since the condition of having entered mutually and having twined is formed, a firm junction condition is constituted and it has high bonding strength and high pressure resistance.
[0036] Especially, in the resin mold goods of this example, since mechanical bonding strength is made to give among both by concavo-convex fitting of fitting heights 11c of the 1st shaping member 11, and fitting crevice 12c of the 2nd shaping member 12, both bonding strength can be raised more by it.
[0037] Moreover, since the curvature in the contact edges 11a and 12a of the 1st shaping member 11 and the 2nd shaping member 12 etc. is corrected by the mechanical bonding strength by concavo-convex fitting, it can suppress that a clearance occurs between contact side 11b of the 1st shaping member 11 and the 2nd shaping member 12, and 12b. For this reason, heat transfer of the generation of heat in contact side 12b of the 2nd shaping member 12 which consists of nontransparent nature resin material can be certainly carried out to contact side 11b of the 1st shaping member 11 which consists of penetrable resin material, and heating melting of the contact side 11b of the 1st shaping member 11 can be carried out certainly. Therefore, it becomes possible to carry out laser joining of contact side 11b of the 1st shaping member 11 and the 2nd shaping member 12, and the 12b certainly.
[0038] Furthermore, since the contact area of the above-mentioned contact side 11b (the dip side face of 11d of fitting heights and an apical surface are included) of the 1st shaping member 11 and the above-mentioned contact side 12b (the dip side face of 12d of fitting crevices and a base are included) of the 2nd shaping member 12, i.e., the plane-of-composition product by laser joining, increases by the above-mentioned concavo-convex fitting, improvement in bonding strength can be aimed at also by this.
[0039] In addition, since the 12d of the above-mentioned fitting crevices is established in the 2nd shaping member 12 which consists of nontransparent nature resin material while preparing the 11d of the above-mentioned fitting heights in the 1st shaping member 11 which consists of penetrable resin material, it can use that a part of laser beam reflects by the inner surface (a base and dip side face) of 12d of these fitting crevices, and becomes advantageous to carrying out laser welding at homogeneity more.
[0040] The desirable configuration in the above-mentioned concavo-convex fitting is explained here below, referring to drawing 4 .
[0041] Among the opposite walls of the couple which forms fitting crevice 12b which consists of nontransparent nature resin material, first, about the low opposite wall 12c1 with lower height If height H1 is too low, the effectiveness of preventing the curvature in contact edge 11a of the 1st shaping member 11 etc. by concavo-convex fitting (inlaw joint), and lessening the clearance between the 1st shaping member 11 and the 2nd shaping member 12 cannot fully be demonstrated. On the other hand, if about 1mm of height H1 of the low opposite wall 12c1 has the effectiveness of the clearance control by this inlaw joint and height H1 is [it is enough and] too high, inconvenience, such as constraint of the exposure range of a laser beam and configuration constraint by the increment in flange width, will be invited. As for the height H1 of the low opposite wall 12c1, it is desirable to be referred to as about 1-3mm, and it is more more desirable than this viewpoint to be referred to as about 1.5-2.5mm. In addition, when board

thickness of the 1st shaping member 11 and the 2nd shaping member 12 is set to t (this example t= 3mm), as for the height H1 of the low opposite wall 12c1, considering as about 0.3t-1t is desirable, and considering as about 0.5t-0.8t is more desirable.

[0042] Moreover, about extent h (=H2-H1) which makes the height H1 of the above-mentioned low opposite wall 12c1 lower than the height H2 of the high opposite wall 12c2, if the value of h is too small, the effectiveness of expanding the range which can irradiate a laser beam, and the area in which laser welding is possible cannot fully be demonstrated. On the other hand, if 1mm or more of values of Above h has the exposure range of this laser beam, and the effectiveness of amplification of laser joining area and the value of h is [it is enough and] too large, the diameter amplification of a laser spot and inconvenience, such as energy-density lowering, will be invited. As for the value of Above h, it is desirable to be referred to as about 1-6mm, and it is more more desirable than this viewpoint to be referred to as about 3-4mm. In addition, as for the value of this h, it is desirable to consider as about 0.3-2t to the board thickness t of the 1st shaping member 11 and the 2nd shaping member 12, and considering as about 1t-1.3t is more desirable.

[0043] And when a laser beam is irradiated from a right angle to a center line C, laser joining of 2 will be carried out in the range shown by the arrow head h of drawing 4 12d of 11d long dip side faces of 2 and fitting crevice 12b of long dip side faces of fitting heights 11b, but if there is 1mm or more of values of this h, it will become possible to fully secure laser joining area and to obtain sufficient bonding strength. Therefore, if a laser beam exposure is carried out from within the limits shown by the arrow head theta of drawing 4 when the value of h is 1mm or more, it can become possible to carry out laser welding of the 1st shaping member 11 and the 2nd shaping member 12 with sufficient bonding strength, and the range of a laser beam which can be irradiated can be made to fully expand.

[0044] Moreover, above-mentioned include-angle alpha to the center line [in / 12d of 11d short dip side faces of 1 and fitting crevice 12b of short dip side faces of fitting heights 11b / 1] C (degree), About above-mentioned include-angle beta (degree) to the center line C in 2, in a list 12d of 11d long dip side faces of 2 and fitting crevice 12b of long dip side faces of fitting heights 11b It is desirable that the include angle alpha of 1 is [12d of short dip side faces equivalent to the inner surface of the low opposite wall 12c1 of fitting crevice 12b / 12d of long dip side faces equivalent to the inner surface of the high opposite wall 12c2 of fitting crevice 12b] larger than the include angle beta of 2. It becomes advantageous, when demonstrating the exposure range of a laser beam, and the effectiveness of amplification of laser joining area, so that an include angle alpha becomes larger than an include angle beta. When an include angle alpha becomes larger than an include angle beta too much, it becomes impossible on the other hand, to fully demonstrate the effectiveness of the clearance control by the inlaw joint. Therefore, especially the thing for which it has the relation which fills following the (1) type between an include angle alpha and an include angle beta is desirable. As an include angle beta, it can carry out to about 10<=beta<=45.

[0045]

beta+10 <= alpha<=beta +40 -- (1)

[0046]

[Effect of the Invention] As explained in full detail above, they can fully secure the range of a laser beam which can be irradiated, and the joining area in which laser welding is possible, the resin mold goods of this invention carrying out concavo-convex fitting of the contact edge of penetrable resin material and nontransparent nature resin material, and preventing generating of the clearance between both.

[0047] Therefore, while being able to aim at improvement in the bonding strength by laser joining, laser joining becomes possible even when the discharge location of a laser beam is restricted by the increase of the degree of freedom of the discharge location of the laser beam in which laser welding is possible, the obstruction, etc.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view of the intake manifold made of synthetic resin which applies the resin mold goods which are applied to an example and applied to this invention.
[Drawing 2] It is the sectional view of the part which starts an example and is shown by the arrow-head A-A line of drawing 1 .
[Drawing 3] It is the amplification fragmentary sectional view in which starting an example and showing the junction structure of the 1st shaping member and the 2nd shaping member.
[Drawing 4] It is the amplification fragmentary sectional view in which starting an example and showing the junction structure of the 1st shaping member and the 2nd shaping member.
[Description of Notations]
11 -- The 1st shaping member (penetrable resin material)
12 -- The 2nd shaping member (nontransparent nature resin material)
11a, 12a -- Contact edge
11b -- Fitting heights
12b -- Fitting crevice
12c1 -- Low opposite wall
12c2 -- High opposite wall

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2002－86567
（P2002－86567A）
(43)公開日　平成14年３月26日(2002.3.26)

(51)Int.Cl.'	識別記号	ＦＩ	ﾃｰﾏｺｰﾄﾞ(参考)
Ｂ２９Ｃ　65/16		Ｂ２９Ｃ　65/16	４Ｆ２１１

審査請求　未請求　請求項の数１　ＯＬ　（全　６　頁）

(21)出願番号　特願2000－273851(P2000－273851)

(22)出願日　平成12年９月８日(2000.9.8)

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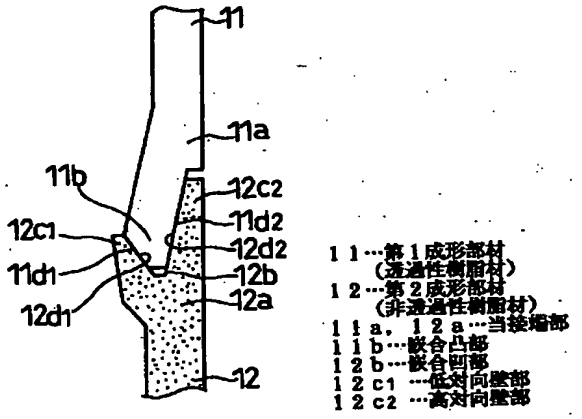
Ｆターム(参考)　4F211 TA16 TC01 TD01 TD02 TN27 TN78

(54)【発明の名称】　樹脂成形品

(57)【要約】
【課題】透過性樹脂材及び非透過性樹脂材の当接端部を凹凸嵌合させて隙間の発生を防止しつつ、該凹凸嵌合における形状を工夫して、レーザ光の照射可能範囲及びレーザ溶着可能な溶着面積を十分に確保する。
【解決手段】　加熱源としてのレーザ光に対して透過性のある透過性樹脂材よりなる第１成形部材１１の当接端部１１ａに嵌合凸部１１ｂが設けられ、該レーザ光に対して透過性のない非透過性樹脂材よりなる第２成形部材１２の当接端部１２ａに嵌合凹部１２ｂが設けられている。嵌合凹部１２ｂを形成する一対の対向壁部は、高対向壁部１２ｃ２と、これより高さの低い低対向壁部１２ｃ１とからなる。低対向壁部１２ｃ１側からレーザ光を照射することにより、レーザ光の照射可能範囲及びレーザ溶着可能な溶着面積を十分に確保することができる。



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【特許請求の範囲】

【請求項１】　加熱源としてのレーザ光に対して透過性のある透過性樹脂材と、該レーザ光に対して透過性のない非透過性樹脂材とからなり、該透過性樹脂材及び該非透過性樹脂材の当接端部同士が該透過性樹脂材側からの該レーザ光の照射により溶着されて接合された樹脂成形品において、

上記透過性樹脂材の上記当接端部に嵌合凸部が設けられるとともに、上記非透過性樹脂材の上記当接端部に該嵌合凸部と嵌合可能な嵌合凹部が設けられ、該嵌合凹部を形成する一対の対向壁部のうちの一方が他方よりも低い高さで形成されていることを特徴とする樹脂成形品。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は樹脂成形品に関しく、詳しくは、レーザ光に対して透過性のある透過性樹脂材と、該レーザ光に対して透過性のない非透過性樹脂材とをレーザ溶着により一体的に接合した樹脂成形品に関する。

【０００２】

【従来の技術】近年、軽量化及び低コスト化等の観点より、自動車部品等、各種分野の部品を樹脂化して樹脂成形品とすることが頻繁に行われている。また、樹脂成形品の高生産性化等の観点より、樹脂成形品を予め複数に分割して成形し、これらの分割成形品を互いに接合する手段が採られることが多い。

【０００３】ここに、樹脂材同士の接合方法として、従来よりレーザ溶着方法が利用されている。例えば、特開昭６０－２１４９３１号公報には、レーザ光に対して透過性のある透過性樹脂材と、該レーザ光に対して透過性のない非透過性樹脂材とを重ね合わせた後、該透過性樹脂材側からレーザ光を照射することにより、透過性樹脂材と非透過性樹脂材との当接面同士を加熱溶融させて両者を一体的に接合するレーザ溶着方法が開示されている。

【０００４】このレーザ溶着方法では、透過性樹脂材内を透過したレーザ光が非透過性樹脂材の当接面に到達して吸収され、この当接面に吸収されたレーザ光がエネルギーとして蓄積される。その結果、非透過性樹脂材の当接面が加熱溶融されるとともに、この非透過性樹脂材の当接面からの熱伝達により透過性樹脂材の当接面が加熱溶融される。この状態で、透過性樹脂材及び非透過性樹脂材の当接面同士を圧着させれば、両者を一体的に接合することができる。

【０００５】

【発明が解決しようとする課題】ところで、上記したようなレーザ溶着では、透過性樹脂材び非透過性樹脂材の当接面同士を確実に溶着させて十分な接合強度を得るためには、透過性樹脂材及び非透過性樹脂材の当接面同士の隙間を極力小さく又は無しにする必要がある。かかる

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当接面に隙間があると、非透過性樹脂材の当接面における発熱が透過性樹脂材の当接面に熱伝達されにくくなるため、透過性樹脂材の当接面における加熱溶融が不十分となって当接面同士が十分に溶着しなくなるためである。

【０００６】そこで、透過性樹脂材の当接端部に嵌合凸部を設けるとともに、非透過性樹脂材の当接端部に嵌合凹部を設けることにより、上記当接面同士の隙間を極力小さくする手段が考えられる。かかる手段によれば、凹凸嵌合による機械的結合力により、当接端部における反り等を矯正して、当接面同士の隙間を小さくすることが可能となる。

【０００７】しかしながら、透過性樹脂材及び非透過性樹脂材の当接端部に嵌合凸部及び嵌合凹部を設けると、凹凸部の形状やレーザ光の照射位置等によっては、照射されたレーザ光が透過性樹脂材に入射することを非透過性樹脂材が遮ることがある。このため、レーザ光の照射可能範囲が狭小化したり、あるいはレーザ溶着されうる溶着面積が狭小化して接合強度が不十分になるという問題が発生する。

【０００８】本発明は上記実情に鑑みてなされたものであり、透過性樹脂材及び非透過性樹脂材の当接端部を凹凸嵌合させて上記隙間の発生を防止しつつ、該凹凸嵌合における形状を工夫して、レーザ光の照射可能範囲及びレーザ溶着可能な溶着面積を十分に確保することのできる樹脂成形品を提供することを解決すべき技術課題とするものである。

【０００９】

【課題を解決するための手段】上記課題を解決する本発明の樹脂成形品は、加熱源としてのレーザ光に対して透過性のある透過性樹脂材と、該レーザ光に対して透過性のない非透過性樹脂材とからなり、該透過性樹脂材及び該非透過性樹脂材の当接端部同士が該透過性樹脂材側からの該レーザ光の照射により溶着されて接合された樹脂成形品において、上記透過性樹脂材の上記当接端部に嵌合凸部が設けられるとともに、上記非透過性樹脂材の上記当接端部に該嵌合凸部と嵌合可能な嵌合凹部が設けられ、該嵌合凹部を形成する一対の対向壁部のうちの一方が他方よりも低い高さで形成されていることを特徴とするものである。

【００１０】

【発明の実施の形態】本発明の樹脂成形品は、加熱源としてのレーザ光に対して透過性のある透過性樹脂材と、該レーザ光に対して透過性のない非透過性樹脂材とからなり、該透過性樹脂材及び該非透過性樹脂材の当接端部同士がレーザ溶着により一体的に接合されている。このレーザ溶着は、透過性樹脂材及び非透過性樹脂材の当接端部同士を当接させた状態で、透過性樹脂材側からレーザ光を照射することにより行われる。透過性樹脂材側から照射されたレーザ光は該透過性樹脂材内を透過して非

透過性樹脂材の当接面に到達し、吸収される。この非透過性樹脂材の当接面に吸収されたレーザ光がエネルギーとして蓄積される結果、非透過性樹脂材の当接面が加熱溶融されるとともに、この非透過性樹脂材の当接面からの熱伝達により透過性樹脂材の当接面が加熱溶融される。この状態で、透過性樹脂材及び非透過性樹脂材の当接面同士を圧着させれば、両者を一体的に接合することができる。

【００１１】こうして得られた接合部では、接合面同士が溶融されて接合されており、該接合面同士の間では両成形部材を構成する両樹脂が溶融して互いに入り込み絡まった状態が形成されているため、強固な接合状態を構成して高い接合強度及び耐圧強度を有している。

【００１２】ここに本発明の樹脂成形品では、透過性樹脂材の当接端部に嵌合凸部が設けられるとともに、非透過性樹脂材の当接端部に該嵌合凸部と嵌合可能な嵌合凹部が設けられており、透過性樹脂材の嵌合凸部と非透過性樹脂材の嵌合凹部とが嵌合している。この凹凸嵌合による機械的な結合力により、透過性樹脂材及び非透過性樹脂材の当接端部における反り等が矯正されるので、透過性樹脂材の当接面と非透過性樹脂材の当接面との間に隙間が発生することを抑えることができる。このため、非透過性樹脂材の当接面における発熱を透過性樹脂材の当接面に確実に熱伝達させて、透過性樹脂材の当接面を確実に加熱溶融させることができる。したがって、透過性樹脂材及び非透過性樹脂材の当接面同士を確実にレーザ溶着させることが可能となる。

【００１３】また、非透過性樹脂材の当接端部に設けられた嵌合凹部は、該嵌合凹部を形成する一対の対向壁部のうちの一方が他方よりも低い高さで形成されている。このため、高さの低い方の対向壁部側からレーザ光を照射することにより、照射されたレーザ光が非透過性樹脂材（レーザ光が照射される側の対向壁部）で遮られるのを抑えることができる。したがって、レーザ光の照射可能範囲及びレーザ溶着可能な溶着面積を十分に確保することが可能となる。

【００１４】さらに、本発明の樹脂成形品では、透過性樹脂材に嵌合凸部を設けるとともに、非透過性樹脂材に嵌合凹部を設けている。ここで、透過性樹脂材内を透過して非透過性樹脂材の当接面（嵌合凹部の内面）に到達したレーザ光は該当接面でその全てが吸収されることはなく一部が反射される。このため、透過性樹脂材内におけるレーザ光の散乱に加えて、非透過性樹脂材の嵌合凹部の内面におけるレーザ光の反射を利用することにより、嵌合凸部の外面及び嵌合凹部の内面同士をより広く、かつ、略均等にレーザ溶着することが可能となる。

【００１５】上記非透過性樹脂材の当接端部に設けられる嵌合凹部の形状としては、該嵌合凹部を形成する一対の対向壁部のうちの一方が他方よりも低い高さで形成されていれば特に限定されず、例えば略逆台形状、略半円状や略三角形状等の断面形状とすることができる。

【００１６】上記透過性樹脂材に用いる樹脂の種類としては、熱可塑性を有し、加熱源としてのレーザ光を所定の透過率以上で透過させうるものであれば特に限定されない。例えば、ナイロン６（ＰＡ６）やナイロン６６（ＰＡ６６）等のポリアミド（ＰＡ）、ポリエチレン（ＰＥ）、ポリプロピレン（ＰＰ）、スチレン－アクリロニトリル共重合体、ポリエチレンテレフタレート（ＰＥＴ）、ポリスチレン、ＡＢＳ、アクリル（ＰＭＭＡ）、ポリカーボネート（ＰＣ）、ポリブチレンテレフタレート（ＰＢＴ）等を挙げることができる。なお、必要に応じて、ガラス繊維、カーボン繊維等の補強繊維や着色材を添加したものを用いてもよい。

【００１７】上記非透過性樹脂材に用いる樹脂の種類としては、熱可塑性を有し、加熱源としてのレーザ光を透過させずに吸収しうるものであれば特に限定されない。例えば、ナイロン６（ＰＡ６）やナイロン６６（ＰＡ６６）等のポリアミド（ＰＡ）、ポリエチレン（ＰＥ）、ポリプロピレン（ＰＰ）、スチレン－アクリロニトリル共重合体、ポリエチレンテレフタレート（ＰＥＴ）、ポリスチレン、ＡＢＳ、アクリル（ＰＭＭＡ）、ポリカーボネート（ＰＣ）、ポリブチレンテレフタレート（ＰＢＴ）、ＰＰＳ等に、カーボンブラック、染料や顔料等の所定の着色材を混入したものを挙げることができる。なお、必要に応じて、ガラス繊維、カーボン繊維等の補強繊維を添加したものを用いてもよい。

【００１８】また、上記透過性樹脂材に用いる樹脂と上記非透過性樹脂材に用いる樹脂との組合せについては、互いに相溶性のあるもの同士の組合せとされる。かかる組合せとしては、ナイロン６同士やナイロン６６同士等、同種の樹脂同士の組合せの他、ナイロン６とナイロン６６との組合せ、ＰＥＴとＰＣとの組合せやＰＣとＰＢＴとの組合せ等を挙げることができる。

【００１９】また、加熱源として用いるレーザ光の種類としては、レーザ光を透過させる透過性樹脂材の吸収スペクトルや板厚（透過長）等との関係で、透過性樹脂材内での透過率が所定値以上となるような波長を有するものが適宜選定される。例えば、ＹＡＧ：Ｎｄ’’レーザ（レーザ光の波長：１０６０ｎｍ）や半導体レーザ（レーザ光の波長：５００～１０００ｎｍ）を用いることができる。

【００２０】なお、レーザの出力、照射密度や加工速度（移動速度）等の照射条件は、樹脂の種類等に応じて適宜設定可能である。

【００２１】

【実施例】以下、本発明の具体的な実施例を図面に基づいて説明する。

【００２２】本実施例は、本発明の樹脂成形品を合成樹脂製のインテークマニホールドに適用したものである。

【００２３】図１はインテークマニホールドの平面図で

ある。図２はインテークマニホールドの図１におけるＡ－Ａ線で切断した切断端面を拡大して示している。

【００２４】このインテークマニホールド１０は、上下に２分割されていて、上側分割体である第１成形部材１１と下側分割体である第２成形部材１２とから構成された中空体である。第１成形部材１１及び第２成形部材１２は、互いに整合して当接し合う当接端部１１ａ及び１２ａをそれぞれ有している。そして、第１成形部材１１の当接端部１１ａ及び第２成形部材１２の当接端部１２ａの当接面同士がレーザ溶着により一体的に接合されている。

【００２５】第１成形部材１１は、加熱源としてのレーザ光に対して透過性のある透過性樹脂よりなるもので、この透過性樹脂として、本実施例ではナイロン６に補強材であるガラスファイバーを３０ｗｔ％添加してなる強化プラスチックを用いた。但し、ガラスファイバーを３０ｗｔ％添加したことにより、ガラスファイバー非添加のナイロン６製のプラスチックに比較してレーザ光の透過率は３０％低下している。なお、照射に使用するレーザ光はＹＡＧ：Nd^{3+}レーザ（波長：１０６０ｎｍ）である。

【００２６】また、第２成形部材１２は、加熱源としてのレーザ光に対して透過性のない非透過性樹脂よりなるもので、この非透過性樹脂として、本実施例ではナイロン６に補強材であるガラスファイバーを３０ｗｔ％、補助剤（着色材）であるカーボンブラックを適宜量添加してなる強化プラスチックを用いた。

【００２７】なお、第１成形部材１１及び第２成形部材１２は、いずれもナイロン６を母材樹脂とするもので、互いに相溶性のあるものである。

【００２８】第１成形部材１１は、図１のＡ－Ａ線で示す部位が図２で拡大して示されているように、断面形状が略半円筒状を呈している。この略半円筒状をなす第１成形部材１１の開口端部に当接端部１１ａが設けられている。

【００２９】この部分がさらに拡大して図３に示されているように、第１成形部材１１の当接端部１１ａには、下方に突出する環状の嵌合凸部１１ｂが設けられている。この嵌合凸部１１ｂは、先端側（下方側）に向かって漸次縮小して突出する略台形状の断面形状をなしている。そして、レーザ光が照射される側（図３の左側）の短傾斜側面１１ｄ１は、反対側の長傾斜側面１１ｄ２よりも短い長さとされている。

【００３０】一方、第２成形部材１２の当接端部１２ａには、上記嵌合凸部１１ｂと嵌合可能な環状の嵌合凹部１２ｂが設けられている。この嵌合凹部１２ｂは、上記嵌合凸部１１ｂと整合する形状とされ、底面から上方に向かって漸次開口が拡がる略台形状の断面形状をなしている。そして、嵌合凹部１２ｂを形成する一対の対向壁部１２ｃ１、１２ｃ２のうちの一方は他方よりも低い高

さで形成されている。すなわち、レーザ光が照射される側（図３の左側）の低対向壁部１２ｃ１は、反対側の高対向壁部１２ｃ２よりも低い高さとされている。なお、低対向壁部１２ｃ１の内面が、上記短傾斜側面１１ｄ１と当接してレーザ溶着される短傾斜側面１２ｄ１となり、高対向壁部１２ｃ２の内面が、上記長傾斜側面１１ｄ２と当接してレーザ溶着される長傾斜側面１２ｄ２となる。

【００３１】さらに詳しくは、図４に示すように、嵌合凸部１１ｂの短傾斜側面１１ｄ１及び嵌合凹部１２ｂの短傾斜側面１２ｄ１は中心線Ｃに対してαの角度で傾斜しており、嵌合凸部１１ｂの長傾斜側面１１ｄ２及び嵌合凹部１２ｂの長傾斜側面１２ｄ２は中心線Ｃに対してβの角度で傾斜している。また、嵌合凹部１２ｂの低対向壁部１２ｃ１の高さはＨ１で、嵌合凹部１２ｂの高対向壁部１２ｃ２の高さはＨ２であり、両者の差がｈ（＝Ｈ２－Ｈ１）とされている。

【００３２】こうして、第１成形部材１１の嵌合凸部１１ｃ及び第２成形部材１２の嵌合凹部１２ｃ同士が嵌合されるとともに、第１成形部材１１の当接面１１ｂ（嵌合凸部１１ｃの短傾斜側面１１ｅ１及び長傾斜側面１１ｅ２）及び第２成形部材１２の当接面１２ｂ（嵌合凹部１２ｃの短傾斜側面１２ｅ１及び長傾斜側面１２ｅ２）同士がレーザ溶着により一体的に接合されている。

【００３３】上記構成を有する本実施例の樹脂成形品は、以下のようにして製造した。まず、所定の射出成形型を用いて、第１成形部材１１及び第２成形部材１２を予め所定形状に射出成形した。そして、第１成形部材１１の嵌合凸部１１ｃと第２成形部材１２の嵌合凹部１２ｃとを嵌合させるとともに、第１成形部材１１及び第２成形部材１２の当接面１１ｂ及び１２ｂ同士を当接させた。この状態で、図示しないレーザトーチを用い、第１成形部材１１側から第２成形部材１２の嵌合凹部１２ｃに向かってレーザ光を照射した。すなわち、第２成形部材１２の嵌合凹部１２ｃを形成する一対の対向壁部のうち高さの低い方の低対向壁部１２ｄ１側から嵌合凹部１２ｃの内面、すなわち嵌合凹部１２ｃの短傾斜側面１２ｅ１及び長傾斜側面１２ｅ２に向かってレーザ光を照射した。これにより、第１成形部材１１の当接端部１１ａと第２成形部材１２の当接端部１２ａとの当接面１１ｂ及び１２ｂ同士を全面的に加熱溶融させて、レーザ溶着により両者を一体的に接合した。

【００３４】このように、本実施例の樹脂成形品では、非透過性樹脂材よりなる第２成形部材１２の当接端部１２ａに設けられた嵌合凹部１２ｃは、レーザ光が照射される側の低対向壁部１２ｄ１が反対側の高対向壁部１２ｄ２よりも高さが低くされている。このため、高さの低い方の低対向壁部１２ｄ１側からレーザ光を照射することにより、照射されたレーザ光が非透過性樹脂材（レーザ光が照射される側の対向壁部）で遮られるのを抑える

ことができる。したがって、レーザ光の照射可能範囲及びレーザ溶着可能な溶着面積を十分に確保することが可能となる。

【００３５】こうして得られた接合部では、当接面１１ｂ及び１２ｂ同士が全面的に溶融されて接合されており、該当接面１１ｂ及び１２ｂ同士の間では両成形部材１１及び１２を構成する両樹脂が溶融して互いに入り込み絡まった状態が形成されているため、強固な接合状態を構成して高い接合強度及び耐圧強度を有している。

【００３６】特に、本実施例の樹脂成形品では、第１成形部材１１の嵌合凸部１１ｃと第２成形部材１２の嵌合凹部１２ｃとの凹凸嵌合により、両者間に機械的な結合力が付与せしめられるので、両者の接合強度をより向上させることができる。

【００３７】また、凹凸嵌合による機械的な結合力により、第１成形部材１１及び第２成形部材１２の当接端部１１ａ及び１２ａにおける反り等が矯正されるので、第１成形部材１１及び第２成形部材１２の当接面１１ｂ及び１２ｂ同士の間に隙間が発生することを抑えることができる。このため、非透過性樹脂材よりなる第２成形部材１２の当接面１２ｂにおける発熱を透過性樹脂材よりなる第１成形部材１１の当接面１１ｂに確実に熱伝達させて、第１成形部材１１の当接面１１ｂを確実に加熱溶融させることができる。したがって、第１成形部材１１及び第２成形部材１２の当接面１１ｂ及び１２ｂ同士を確実にレーザ溶着させることが可能となる。

【００３８】さらに、上記凹凸嵌合により、第１成形部材１１の上記当接面１１ｂ（嵌合凸部１１ｄの傾斜側面及び先端面を含む）と第２成形部材１２の上記当接面１２ｂ（嵌合凹部１２ｄの傾斜側面及び底面を含む）との当接面積、すなわちレーザ溶着による接合面積も増大することから、これによっても接合強度の向上を図ることができる。

【００３９】加えて、透過性樹脂材よりなる第１成形部材１１に上記嵌合凸部１１ｄを設けるとともに、非透過性樹脂材よりなる第２成形部材１２に上記嵌合凹部１２ｄを設けているので、該嵌合凹部１２ｄの内面（底面及び傾斜側面）でレーザ光の一部が反射することを利用することができ、より均一にレーザ溶着するのに有利となる。

【００４０】ここに、上記凹凸嵌合における好ましい形状について、図４を参照しつつ以下説明する。

【００４１】まず、非透過性樹脂材よりなる嵌合凹部１２ｂを形成する一対の対向壁部のうち高さの低い方の低対向壁部１２ｃ１については、高さＨ１が低すぎると、凹凸嵌合（インロー継手）により第１成形部材１１の当接端部１１ａ等における反り等を防止して第１成形部材１１及び第２成形部材１２間の隙間を少なくするという効果を十分に発揮できない。一方、このインロー継手による隙間抑制の効果は、低対向壁部１２ｃ１の高さＨ１がｌｍｍ程度あれば十分であり、また高さＨ１が高すぎると、レーザ光の照射範囲の制約やフランジ幅増加による形状制約等の不都合を招来する。かかる観点より、低対向壁部１２ｃ１の高さＨ１はｌ～３ｍｍ程度とすることが好ましく、１．５～２．５ｍｍ程度とすることがより好ましい。なお、第１成形部材１１及び第２成形部材１２の板厚をｔ（本実施例ではｔ＝３ｍｍ）としたとき、低対向壁部１２ｃ１の高さＨ１は、０．３ｔ～１ｔ程度とすることが好ましく、０．５ｔ～０．８ｔ程度とすることがより好ましい。

【００４２】また、上記低対向壁部１２ｃ１の高さＨ１を高対向壁部１２ｃ２の高さＨ２よりも低くする程度ｈ（＝Ｈ２－Ｈ１）については、ｈの値が小さすぎると、レーザ光の照射可能な範囲及びレーザ溶着可能な面積を拡大するという効果を十分に発揮できない。一方、このレーザ光の照射範囲及びレーザ溶着面積の拡大の効果は、上記ｈの値がｌｍｍ以上あれば十分であり、またｈの値が大きすぎるとレーザスポット径拡大や、エネルギー密度低下等の不都合を招来する。かかる観点より、上記ｈの値はｌ～６ｍｍ程度とすることが好ましく、３～４ｍｍ程度とすることがより好ましい。なお、このｈの値は、第１成形部材１１及び第２成形部材１２の板厚ｔに対して、０．３～２ｔ程度とすることが好ましく、ｌｔ～ｌ．３ｔ程度とすることがより好ましい。

【００４３】そして、中心線Ｃに対して直角方向からレーザ光を照射した場合、嵌合凸部１１ｂの長傾斜側面１１ｄ２と嵌合凹部１２ｂの長傾斜側面１２ｄ２とが図４の矢印ｈで示す範囲でレーザ溶着されることになるが、このｈの値がｌｍｍ以上あればレーザ溶着面積を十分に確保して十分な接合強度を得ることが可能となる。したがって、ｈの値がｌｍｍ以上のとき、図４の矢印θで示す範囲内からレーザ光照射すれば、第１成形部材１１と第２成形部材１２とを十分な接合強度をもってレーザ溶着することが可能となり、レーザ光の照射可能範囲を十分に拡大させることができる。

【００４４】また、嵌合凸部１１ｂの短傾斜側面１１ｄ１及び嵌合凹部１２ｂの短傾斜側面１２ｄ１における中心線Ｃに対する上記角度α（°）、並びに嵌合凸部１１ｂの長傾斜側面１１ｄ２及び嵌合凹部１２ｂの長傾斜側面１２ｄ２における中心線Ｃに対する上記角度β（°）については、嵌合凹部１２ｂの低対向壁部１２ｃ１の内面に相当する短傾斜側面１２ｄ１の角度αが、嵌合凹部１２ｂの高対向壁部１２ｃ２の内面に相当する長傾斜側面１２ｄ２の角度βよりも大きいことが好ましい。角度αが角度βよりも大きくなるほど、レーザ光の照射範囲及びレーザ溶着面積の拡大の効果を発揮させる上で有利となる。一方、角度αが角度βよりも大きくなりすぎると、インロー継手による隙間抑制の効果を十分に発揮できなくなる。したがって、角度αと角度βとの間には、下記（１）式を満たす関係にあることが特に好ましい。

角度βとしては、１０≦β≦４５程度とすることができる。

$$\beta+10\leqq\alpha\leqq\beta+40 \quad \cdots(1)$$

【００４６】

【発明の効果】以上詳述したように、本発明の樹脂成形品は、透過性樹脂材及び非透過性樹脂材の当接端部を凹凸嵌合させて両者間の隙間の発生を防止しつつ、レーザ光の照射可能範囲及びレーザ溶着可能な溶着面積を十分に確保することができる。

【００４７】したがって、レーザ溶着による接合強度の向上を図ることができるとともに、レーザ溶着可能なレーザ光の発射位置の自由度が増し、障害物等によりレーザ光の発射位置が制限される場合でもレーザ溶着が可能となる。

【図面の簡単な説明】

【図１】実施例に係り、本発明に係る樹脂成形品を適用する合成樹脂製のインテークマニホールドの平面図である。

【図２】実施例に係り、図１の矢印Ａ－Ａ線で示す部位の断面図である。

【図３】実施例に係り、第１成形部材と第２成形部材との接合構造を示す拡大部分断面図である。

【図４】実施例に係り、第１成形部材と第２成形部材との接合構造を示す拡大部分断面図である。

【符号の説明】

１１…第１成形部材（透過性樹脂材）

１２…第２成形部材（非透過性樹脂材）

１１ａ、１２ａ…当接端部

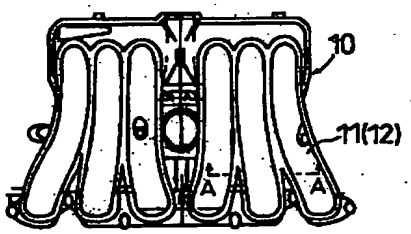
１１ｂ…嵌合凸部

１２ｂ…嵌合凹部

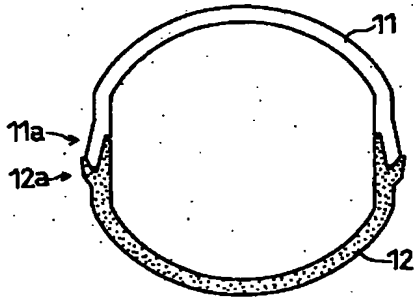
１２ｃ１…低対向壁部

１２ｃ２…高対向壁部

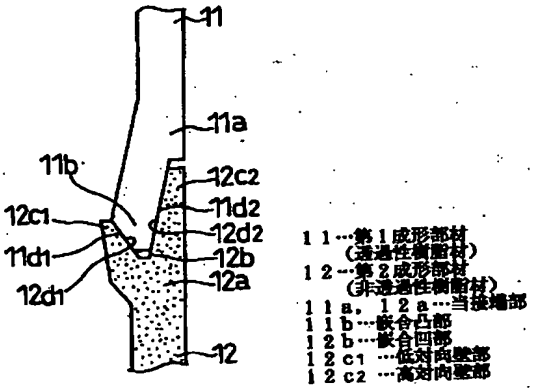
【図１】



【図２】



【図３】



【図４】